

REQUEST FOR PROPOSALS

CENTRAL CALIFORNIA OZONE STUDY (CCOS)

IMPROVE CONSERVATION OF MASS MODULE IN AIR QUALITY MODELS

June 28, 2005

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1. BACKGROUND

The mathematical structure of certain algorithms in atmospheric, dispersion and air quality models may be based on assumptions and simplifications that can lead to incomplete treatment of mass conservation. One of the main problems in atmospheric models is incomplete treatment of the continuity equation that consequently induces mass inconsistency of species in some photochemical and other chemical models. An additional problem arises for air quality modeling applied to regional and mesoscale domains when the inflow of total air mass is supplied by large-scale models based on incompressibility and hydrostatic assumptions with governing equations in a non-conservative form. These are very important issues since air quality models require strictly mass-consistent atmospheric input to ensure mass conservation of trace gases. Practical solutions that introduce mass adjustment terms in some or all components of the modeling system (atmospheric, dispersion, and chemical modules) occasionally introduce large mass corrections that can bring large errors, bias, and artificial compensating effects when applied to SIP models.

Considerations in the theoretical formulation of atmospheric and air quality models and mass conservation issues are discussed by Byun (1999a and 1999b). Adjustments to wind and air density fields have been studied and implemented in previous air quality modeling studies. Odman and Russell (2000) describe numerical experiments that adjusted the vertical wind component and the vertical flux. Lu et al. (1997) took an approach of adjusting the density field. An alternative approach is to simply design an integrated air quality modeling system that directly incorporates the mass conservation feature. For example, WRF, the model that replaces MM5, and its associated air quality model, WRF-Chem, have been designed to eliminate the mass conservation problem.

This project will focus on characterizing the impacts of mass conservation errors on current CCOS modeling results. If significant mass conservation issues are found, then an assessment will be made of alternative means for rectifying such problems in upcoming SIP modeling analyses. A companion study is being carried out by NOAA to address mass conservation issues associated with supporting meteorological models employed in the CCOS. It is expected that the Contractor will coordinate activities and work closely with the NOAA investigators.

2. TECHNICAL OBJECTIVES

In principle, a fully-coupled meteorological-chemical model (Seaman 1995) would avoid most of the mass inconsistency effects. A meteorological model needs to be fully incompressible with governing equations in the conservative form and using a coordinate system that fully preserves mass. In this case, all meteorological parameters should be available at the finite time steps needed for the air quality model.

Since most air quality models currently use meteorological models that are not fully conserving mass, various correction terms to account for mass consistency have been developed. These correction procedures need to be evaluated. It is also important to understand the additional assumptions and approximations in air quality

computations that lead to errors and uncertainties in the estimated concentrations. These include:

- Inaccuracies due to temporal interpolation of the velocity and density fields that are used in chemistry transport models.
- Choice of time-independent vertical coordinates that do not allow full conservation of mass.
- Assumptions and simplifications in the treatment of the atmospheric dynamics such as incompressibility, hydrostatic approximation, non-divergent flow, and the Boussinesq approximation that affect the full treatment of mass conservation through the continuity equation.
- Assumptions and simplifications of the treatment of topography in the atmospheric models that eventually lead to erroneous computations of the pressure and density fields.
- Treatment of dry and wet deposition processes and their effect on mass conservation.
- Interaction of trace species with the earth's surface and their detrainment in the free atmosphere.
- Chemical transformation mechanisms that are not fully incorporated in the treatment of mass conservation.

The purpose of this study is to evaluate the mass-correction algorithms that are being used in the CCOS air quality modeling program. Particular attention is to be given to an examination of both CAMx and CMAQ. The analysis should quantify the effects of mass-correction terms and possible inconsistencies in other components of the air quality models. The study should also propose more effective and accurate ways of improving or fully incorporating treatment of mass conservation.

3. SCOPE OF WORK

The study will be carried out in two phases. In Phase 1, an assessment will be made of the possible importance of mass conservation errors and the identification of practical means to rectify such problems. If appropriate, Phase 2 will entail the development, implementation, and testing of an improved model formulation for treating mass conservation issues. In both Phases 1 and 2, particular attention is to be given to coordinating activities with those of a companion study being carried out by NOAA addressing similar issues for pertinent prognostic meteorological models.

Phase 1 will consist of the following four tasks:

Task 1-1. Document sources of mass conservation problems in CAMx and CMAQ air quality models. Review the derivation of the governing equations for each model,

noting assumptions invoked or parameterizations employed that may cause violations of mass conservation. Identify elements of the numerical solution procedures that may contribute to violations of mass conservation. Review other studies that address mass conservation issues. Identify alternative means for treating mass conservation and assess their strengths, limitations, and range of applicability. Prepare a technical memorandum discussing the findings of this task.

Task 1-2. Characterize errors associated with existing CCOS modeling results arising from mass conservation problems. Review existing CCOS and 2004 SIP update air quality modeling efforts for central and northern California. Working with members of the CCOS Technical Committee, identify and acquire the computer codes and a complete set of model inputs and outputs for both CAMx and CMAQ. Replicate at least one existing CAMx and CMAQ base case simulation. Conduct analyses for both CAMx and CMAQ to quantify the influence of the various sources of mass conservation errors on the resulting pollutant concentration fields. Identify the times and locations of significant problems and the underlying causes.

Task 1-3. Identify improved means for dealing with mass conservation issues in CAMx and CMAQ. Based on the findings of Task 1-2, determine which elements of CAMx and CMAQ require modification to eliminate or significantly reduce key sources of mass conservation error. Address modifications in CAMx and CMAQ that may be needed to accommodate recommended modifications to prognostic meteorological models developed in the NOAA companion study. Conduct an initial cost-benefit analysis to determine if one or more user-selected options should be implemented for treating mass conservation issues. Develop specific recommendations for proposed model modifications or identify the elements of a development program that will produce the needed modifications.

Task 1-4. Document findings of Phase 1, develop a work plan for Phase 2, and meet with the Technical Committee. Prepare a draft final report discussing the findings of Phase 1 activities. If the Phase 1 findings indicate that further work is needed in Phase 2, prepare a draft work plan for proposed Phase 2 activities, including a discussion of schedule and required budget. Participate in a one-day meeting with the CCOS Technical Committee in Sacramento, California, to discuss the findings of the study and comments on the draft final report for Phase 1 and, if appropriate, the draft work plan for Phase 2. Based on the comments received, prepare and submit a final report for Phase 1 and, if appropriate, a final work plan for Phase 2.

If further work is required to develop improved treatments of mass conservation in CAMx and/or CMAQ, then Phase 2 will consist of the following three tasks:

Task 2-1. Develop, implement, and test improved mass conservation modules and procedures for CAMx and CMAQ. Based on the final work plan for Phase 2, develop and implement modifications to CAMx and CMAQ that will provide better adherence to mass conservation principles. Where appropriate, provide facilities to allow the user to

select various mass conservation options. Conduct tests to assure code modifications have been implemented properly.

Task 2-2. Conduct CAMx and CMAQ simulations to assess changes to modeling results from use of the revised codes. Perform CAMx and CMAQ simulations using the revised codes developed in Task 2-1 and compare the results with those generated using the original codes in Task 1-2. Conduct analyses to characterize any residual mass conservation errors. Perform a cost-benefit analysis to help users to determine which mass conservation options may be most appropriate for different types of model applications.

Task 2-3. Prepare study documentation and meet with the Technical Committee. Document the modifications made to CAMx and CMAQ, as well as the testing that was done to assure that code changes were implemented correctly. Include appropriate documentation as might be needed to supplement the existing CAMx and CMAQ user's guides. Prepare and submit a draft final report discussing the findings of both Phase 1 and Phase 2 activities as well as a draft manuscript suitable for publication in a peer-reviewed journal. Participate in a one-day meeting with the CCOS Technical Committee in Sacramento, California, to discuss the findings of the study and comments on the draft final report and draft manuscript. Considering comments provided by the Technical Committee, prepare and submit a final report. Prepare and submit the final manuscript to a peer-reviewed journal for publication.

4. REFERENCES

Byun, D. W., 1999. Dynamically consistent formulations in meteorological and air quality models for multiscale atmospheric studies. Part I: Governing equations in a generalized coordinate system. *J. Atmos. Sci.*, **56**, 3789-3807.

Byun, D. W., 1999. Dynamically consistent formulations in meteorological and air quality models for multiscale atmospheric studies. Part II: Mass conservation issues. *J. Atmos. Sci.*, **56**, 3808-3820.

Lu, R.; Turco, R.P.; Jacobson, M.Z., 1997. An integrated air pollution modeling system for urban and regional scales: 1. Structure and performance. *J. Geophys. Res.* 102:6063.

Odman, M.T., and Russell, A.G., 2000. Mass conservative coupling of non-hydrostatic meteorological models with air quality models, *Air Pollution Modelling and Its Application XIII*, S.-E. Gryning and E. Batchvarova, Kluwer Academic/Plenum Publishers, New York, 651-660.

Seaman, N., 1995. Status of meteorological pre-processors for air-quality modeling. Proc. Int. Conf. On Particulate Matter, Pittsburgh, PA, Air and Waste Management Association, pp. 639-650.

5. MANAGEMENT STRUCTURE

The CCOS is a program involving many sponsors and participants. Three entities are involved in the overall management of the Study. The San Joaquin Valleywide Air Pollution Study Agency, a joint powers agency (JPA) formed by the nine counties in the Valley, directs the fund-raising and contracting aspects of the Study. A Policy Committee comprised of four voting blocks (State, local, and federal government, and the private sector) provides guidance on the Study objectives and funding levels. The Policy Committee approves all proposal requests, contracts, and reports. A Technical Committee parallels the Policy Committee in membership and provides overall technical guidance on proposal requests, direction and progress of work, contract work statements, and reviews all technical reports produced from the Study.

On a day-to-day basis, the ARB is responsible for management of the Study under the direction of the Program Manager, Chief of the ARB Modeling and Meteorology Branch. The ARB monitors contracts with the participants and is the primary interface between Contractors, the Policy and Technical Committees, and the JPA. Members of the Technical Committee are active participants in modeling analyses and in the review of proposals, reports, and publications.

6. BUDGET

This project will be funded in two phases. The total funding for Phases 1 and 2 is not to exceed \$200,000. The Contractor should provide a cost estimate for Phase 1. It is recognized that there may be some uncertainty concerning the scope of Phase 2 activities. A cost estimate for Phase 2 should be made based on the Contractor's assessment of the most likely model modification scenario. Some adjustment to the budget for Phase 2 may be made based on the findings of Phase 1 and the results from the companion study being performed by NOAA.

7. SCHEDULE

The study will be carried out in two phases. Phase 1 will provide an assessment of the possible importance of mass inconsistency effects and the identification of means to rectify such problems. Work on Phase 1 is to be completed within four months of initiating the study. Phase 2, if required, will entail the development, implementation, and testing of an improved means for treating mass conservation in CAMx and/or CMAQ. Phase 2 is to be completed, including the provision of all documentation and deliverables, within one year of implementing the study. Work on Phases 1 and 2 is not to begin prior to receipt of written authorization from the ARB Project Manager.

As part of Task 1-4, the Contractor will participate in a one-day meeting with the CCOS Technical Committee in Sacramento, CA. This meeting will be to discuss the

findings of Phase 1 of the study, the draft final report for Phase 1, and, if appropriate, the draft work plan for proposed Phase 2 activities. If work under Phase 2 is authorized, a second one-day meeting will be held with the CCOS Technical Committee in Sacramento, CA. This second meeting (as part of Task 2-3) will be to discuss the findings of Phase 2 activities and the draft final report and manuscript. Shown below is a time line for the various stages of this contract. Potential Contractors can assume that comments on draft documents will be received within 30-days following submittal.

- | | |
|---|---|
| • Release of the RFP | June 28, 2005 |
| • Submission of bids | July 19, 2005 |
| • Contract Initiation | Mid August 2005 |
| • Submit Technical memorandum (Task 1-1) | 6 weeks after contract initiation |
| • Submit draft Phase 1 report and draft Phase 2 work plan | 4 months after contract initiation |
| • Submit final Phase 1 report and final Phase 2 work plan | 30 days after receipt of comments on draft report and work plan |
| • Submit draft final report, draft manuscript, computer codes, files, and documentation | 10 months after contract initiation |
| • Submit final report and manuscript | 12 months after contract initiation |

8. ADMINISTRATION

The group selected to conduct this work will report to the ARB Program Manager. The period of performance of this contract will be 12 months, with work expected to commence in approximately mid August of 2005. Contract performance is not to begin until a contract is fully approved by the San Joaquin Valleywide Air Pollution Study Agency.

9. CONTRACT REQUIREMENTS

A. Reporting and Other Requirements

The Contractor shall deliver a draft report describing the findings of Phase 1 activities and, if appropriate, a draft work plan for Phase 2 activities. Responding to comments provided by the Technical Committee, the Contractor will submit a final Phase 1 report and final Phase 2 work plan (if appropriate) within one month of receipt of comments from the Technical Committee. If Phase 2 activities are authorized, the

Contractor will submit a draft final report and a draft manuscript suitable for publication in a peer reviewed journal. The Contractor will also deliver all computer source codes incorporating the improved treatment of mass conservation in CAMx and/or CMAQ, as well as any other input files needed to run the model. Documentation will be provided describing all file naming conventions, changes made to the original source codes, and any user instructions needed to facilitate use of the models.

The Contractor will attend a one-day meeting as part of Task 1-4 as well as a second one-day meeting as part of Task 2-3 (assuming authorization is given to conduct Phase 2 activities). It should be assumed that meetings will be held in Sacramento, California.

The Contractor shall deliver monthly progress reports to the ARB Program Manager. Payment of invoices will not be made until receipt of the associated progress report.

The Contractor shall deliver invoices to the ARB Program Manager. With respect to the payment period completed, the invoices shall set forth in detail by task, in accordance with the contract budget, charges for time expended on the project, including classification of personnel involved in such time expenditure, and the monthly, weekly, or hourly rates for such personnel, as appropriate. The invoices shall also contain an itemization of all materials used for the project, including the purpose of its use and its cost. All work billed for in each invoice must be covered in an associated progress report. Therefore, if invoicing is done more frequently than quarterly, progress reports coincident with the payment period must also be provided.

The Contractor shall deliver a draft Phase 1 report, a draft final report, and a draft manuscript for publication, each with two hardcopies, one electronic copy in Adobe Acrobat (PDF) format, and one in Microsoft Word (DOC) format. The Contractor will receive comments on these reports within 30 days of submission, with revisions due within 30 days after receipt of review comments (also with 2 hardcopies, PDF, and DOC versions). The Contractor will be responsible for paying all costs associated with publication of the manuscript.

All model source codes, input and output files, and pertinent documentation will be provided in accordance with the specifications developed in the Phase 2 work plan.

B. Correspondence

All technical correspondence regarding this contract should be sent to the Program Manager at the address listed below:

Mr. John DaMassa, Chief
Modeling & Meteorology Branch
Planning and Technical Support Division
California Air Resources Board
Program Manager
Central California Air Quality Studies
1001 "I" Street

Sacramento, California 95814

C. Contract Language

A copy of the contract language is presented in Appendix A. Any proposed revisions to the contract language **must** be included as part of the proposal. Questions regarding the contract should be directed to the JPA attorney at the address provided below:

Mr. Philip Jay
San Joaquin Valleywide Air Pollution Study Agency Counsel
San Joaquin Valley Unified Air Pollution Control District
1990 East Gettysburg Avenue
Fresno, California 93727
(559) 230-6033

10. PROPOSAL PREPARATION AND EVALUATION GUIDELINES

A. Proposal Contents

Proposals should convey a maximum of technical content related to the relevant task with a minimum of extraneous material. Proposals should convey a high degree of technical understanding and innovation while demonstrating the ability to present complex scientific results to technically qualified decision-makers. Vague references to “standardized”, “EPA”, “ARB”, or other unexplained and non-documented methods will be considered unresponsive and rejected.

The proposal should be clear and concise (typically not more than 30 pages maximum for each question or task, and preferably exclusive of resumes and proponent facilities/experience, which should also be minimal and can be incorporated by reference to a corporate web site). The proposal should address the following issues:

1. *The technical approach for answering each question/task.* The technical approach should build upon, verify or challenge, and add to existing knowledge. The technical approach should include re-formulation or better articulation of the tasks, a brief summary of current knowledge on the topic from central California and elsewhere (where relevant), available methods to answer the questions and a rationale for selecting the proposed method(s), a description of the analysis approach and the data to be used, methods to verify the generality of the results, methods to qualify the conclusions, and a brief outline for the final report and publication.
2. *Staffing, management oversight, and data management.* Extensive management oversight is not solicited or encouraged, as it is expected that each task will require substantial commitment and participation of an experienced specialist in the area with appropriate delegation to support personnel.

3. *A brief statement of qualifications for the proposed participants and a description of the duties they will perform, including a specific discussion of relatively recent project experience.* Greater detail may be incorporated by reference to a corporate website (preferred) or as a standard package. Extensive corporate experience is not as important as the qualifications of the principals who will be dedicated to the proposed task.
4. *The estimated budget for each task should be summarized on the cost reporting form shown in Table 1.* This cost summary form should be supplemented with appended documentation detailing:
 - a. Commitments and hourly rates for personnel.
 - b. Types and costs for travel, equipment, or supplies procured as part of the project.
 - c. One-time costs that apply to all tasks, but that are only listed in one (identify the costs and the tasks in which they are included or excluded).
 - d. Expected cost increases such as annual salary adjustments should also be specified. It is anticipated that this contract will be awarded on a time and materials basis with a maximum (not to exceed) value.
5. *The management approach for dealing with routine operations, unexpected problems, and changes in work scope.*
6. *A project schedule, describing the start and end dates for each task, and the completion date for each deliverable specified in the scope of work.*

B. Guidelines and Criteria for Proposal Evaluation

Respondents should demonstrate knowledge and experience in the application of advanced photochemical air quality simulation models and in the diagnosis and rectification of modeling problems. A good understanding should be shown of the theoretical basis of contemporary models, the implementation of numerical procedures for solving the governing equations, as well as mass conservation issues. The following specific criteria will be used to evaluate the proposals:

1. Technical approach for implementing the tasks specified under the Scope of Work. (30 points)
2. The experience, competence, capability, and commitment of the proposed personnel to be assigned to the project. (30 points)
3. The proponent's technical performance on similar, past projects and the extent to which the participant can draw directly on past experience in meeting the requirements of the RFP. (25 points)

4. The overall proposed cost of the work as well as cost-effectiveness, and the proponent's willingness to enter into a contractual agreement that minimizes the risk of cost overrun. (15 points)

C. Conflict of Interest Requirements

Government Code Section 1090 generally prohibits a public official from being financially interested in a contract which he or she has made or participated in an official capacity. Under certain circumstances, persons who perform work pursuant to a contract with a government agency may be subject to the restrictions of Government Code Section 1090.

With respect to CCOS, this means that based on participation in the planning of the Study, certain consultants are precluded from participating in all or some of the post-planning contracts. This preclusion would apply to these consultants as either a prime Contractor or a Subcontractor. In most cases, whether a particular consultant is eligible to bid will depend on an analysis of all of the circumstances surrounding the consultant's earlier participation in CCAQS and the work that the consultant now proposes to perform.

Any response to this RFP which includes a paid participant who is ineligible based on Government Code Section 1090 will be rejected during the format review of the proposals.

Questions concerning the eligibility of a potential bidder must be directed to the JPA attorney at the address provided below prior to the preparation of a proposal:

Mr. Philip Jay
San Joaquin Valleywide Air Pollution Study Agency Counsel
San Joaquin Valley Unified Air Pollution Control District
1990 East Gettysburg Avenue
Fresno, California 93727
(559) 230-6033

D. Submittal Requirements

An original **and two (2) hardcopies of** your proposal and an electronic PDF file of the proposal shall be sent with a cover letter to the ARB Program Manager, Mr. John DaMassa, at the address listed in the Contract Requirements section. Hand carried or express mail packages may be delivered to Mr. John DaMassa at the California Air Resources Board, 1001 "I" Street, Sacramento, California 95814.

TABLE 1
PROPOSAL BUDGET SUMMARY

DIRECT COSTS:

- | | |
|--|----------|
| 1. Labor & Employee Fringe Benefits (provide detailed breakdown by task and employee on separate sheet [including subContractors]) | \$ _____ |
| 2. Equipment (provide detailed breakdown on separate sheet) | \$ _____ |
| 3. Travel & Subsistence | \$ _____ |
| 4. Electronic Data Processing | \$ _____ |
| 5. Photocopying/Printing/Mail/Telephone/FAX | \$ _____ |
| 6. Materials and Supplies | \$ _____ |
| 7. Miscellaneous (please specify) | \$ _____ |

TOTAL DIRECT COST: \$ _____

INDIRECT COSTS:

- | | |
|---|----------|
| 8. Overhead (specify rate) | \$ _____ |
| 9. General & Administrative Expenses (specify rate) | \$ _____ |
| 10. Other Indirect Costs (please specify) | \$ _____ |
| 11. Fee or Profit (specify rate) | \$ _____ |

TOTAL INDIRECT COST: \$ _____

TOTAL DIRECT AND INDIRECT COST: \$ _____

APPENDIX A

CONTRACT LANGUAGE

CONTRACT NO. 05-x CCOS

SAN JOAQUIN VALLEYWIDE AIR POLLUTION STUDY AGENCY

AND

CONTRACTOR

This Agreement, which shall be effective upon the *DATE*, by and between the SAN JOAQUIN VALLEYWIDE AIR POLLUTION STUDY AGENCY (hereafter "STUDY AGENCY"), a joint powers agency, and *CONTRACTOR* (hereafter "CONTRACTOR").

W I T N E S S E T H:

WHEREAS, STUDY AGENCY has the need to *TASK*;

WHEREAS, STUDY AGENCY released its Request for Proposal entitled "*RFP TITLE*" dated *DATE* ("the RFP"), which is incorporated herein, to those persons determined by STUDY AGENCY to be capable of *TASK*

WHEREAS, CONTRACTOR responded to said RFP by sending STUDY AGENCY its Proposal, dated *DATE*, ("the Proposal"), which is incorporated herein;

WHEREAS, STUDY AGENCY has requested CONTRACTOR to perform such services pursuant to the terms and conditions of its RFP; and

WHEREAS, CONTRACTOR represents that it is willing and able to perform the foregoing services requested by STUDY AGENCY pursuant to the terms and conditions thereof.

NOW, THEREFORE, the parties hereby agree as follows:

1. EMPLOYMENT OF CONTRACTOR

1.1 STUDY AGENCY shall employ CONTRACTOR as an independent Contractor to provide, to the reasonable satisfaction of the STUDY AGENCY, those expert consulting services requested to be performed pursuant to Exhibit A of this Agreement, "Scope of

Work," which is attached hereto and incorporated herein, the RFP, and the Proposal. In the event of any conflict between or among the terms and conditions of this Agreement, the exhibits incorporated herein, and the documents referred to and incorporated herein be resolved by giving precedence in the following order of priority:

1.1.1 To the text of this Agreement, Exhibit A, "Scope of Work," to this Agreement, Exhibit B, "Schedule of Deliverables"; and

1.1.2 To the RFP.

1.2 In addition to those obligations stated in paragraph 1.1 of this Agreement, CONTRACTOR shall provide STUDY AGENCY with one (1) reproducible master copy of each written work product completed pursuant to this Agreement, one (1) bound copy of each written work product, one (1) electronic copy in Adobe Acrobat, and one (1) electronic copy in Microsoft Word.

1.3 All work product that CONTRACTOR shall deliver to STUDY AGENCY hereunder shall be performed according to the work schedule and deadlines for performance identified in Exhibit B, "Schedule of Deliverables," to this Agreement, which is attached hereto and incorporated herein.

1.4 CONTRACTOR shall provide its services through the following key persons: *KEY PERSONS*.

1.5 It is the express intent of the parties to preserve the respective teams of the aforementioned key persons through the entire term of this Agreement. In case of death, illness, or other incapacity of any of the foregoing key persons, CONTRACTOR shall use its best efforts to promptly provide a replacement key person of at least equal professional ability and experience as the key person replaced, without additional cost to STUDY AGENCY. CONTRACTOR may add to or replace persons on its support staff without STUDY AGENCY's approval, provided, however, that replacement support staff personnel shall be of at least equal ability as the person(s) replaced. Notwithstanding anything else stated to the contrary in this

Agreement, it is understood that CONTRACTOR may not replace any of the aforementioned key persons without the prior, express written approval of the STUDY AGENCY.

1.6 Subject to any express limitations established by STUDY AGENCY as to the degree of care and amount of time and expense to be incurred and any other limitations expressly contained in this Agreement, CONTRACTOR shall perform the services under this Agreement with that level of due care and skill ordinarily exercised by other qualified professional consultants in the field of CONTRACTOR's expertise under similar circumstances at the time the services are being performed.

1.7 CONTRACTOR may retain such subContractors and/or subconsultants as CONTRACTOR deems necessary to assist CONTRACTOR in completing the work under this Agreement. Such subContractors and subconsultants, if any, shall be expressly approved in writing by STUDY AGENCY before they are retained to perform work under this Agreement. CONTRACTOR's use of any such subContractors or subconsultants shall not, in any way whatsoever, relieve CONTRACTOR of its obligations under subparagraph 1.1 of this Agreement. It is understood that CONTRACTOR shall be STUDY AGENCY's sole point of contact in the performance of the services covered by this Agreement.

1.8 CONTRACTOR's obligation under this Agreement shall be deemed discharged only after all tasks identified in paragraph 1.1 have been completed and approved by the STUDY AGENCY "Technical Committee."

2. NO THIRD-PARTY BENEFICIARIES

2.1 It is understood that CONTRACTOR's services under this Agreement are being rendered only for the benefit of STUDY AGENCY, and no other person, firm, corporation, or entity shall be deemed an intended third-party beneficiary of this Agreement.

3. TERM

3.1 This Agreement shall become effective upon execution by the parties and shall continue until terminated as provided herein. In no event shall the term of this Agreement extend past *DATE*, without the express, written consent of the parties hereto.

4. TERMINATION

4.1 STUDY AGENCY shall have the right to terminate this Agreement at its discretion, and without cause, at any time upon the giving to CONTRACTOR thirty (30) days' advance, written notice of an intention to terminate. If STUDY AGENCY terminates this Agreement in such event, CONTRACTOR shall be compensated for services satisfactorily provided to STUDY AGENCY up to the date of termination, as reasonably determined by STUDY AGENCY, together with such additional services performed after termination which are expressly authorized in writing by STUDY AGENCY to wind up such work.

4.2 The parties hereto may mutually agree to terminate this Agreement at any time, and in such case, upon any terms as are mutually agreeable, provided that such agreement is made pursuant to a written amendment to this Agreement.

4.3 CONTRACTOR shall have the right to terminate this Agreement immediately if:

4.3.1 STUDY AGENCY defaults in the payment of any sum due to be paid to CONTRACTOR; and

4.3.2 Such default for failure to pay or failure to perform any other obligation hereunder continues thirty (30) days after written notice thereof has been provided by CONTRACTOR to STUDY AGENCY.

4.4 Breach of Agreement: STUDY AGENCY may immediately suspend or terminate this Agreement, in whole or in part, where in the determination of STUDY AGENCY there is:

4.4.1 An illegal or improper use of funds;

4.4.2 A failure to comply with any term of this Agreement;

4.4.3 A substantially incorrect or incomplete report submitted to STUDY AGENCY;

4.4.4 Improperly performed services; or

4.4.5 Any other breach of the Agreement.

In no event shall any payment by STUDY AGENCY constitute a waiver by STUDY AGENCY of any breach of this Agreement or any default which may then exist on the part of CONTRACTOR. Neither shall such payment impair or prejudice any remedy available to STUDY AGENCY with respect to the breach or default. STUDY AGENCY shall have the right to demand of CONTRACTOR the repayment to STUDY AGENCY of any funds disbursed to CONTRACTOR under this Agreement which in the judgment of STUDY AGENCY were not expended in accordance with the terms of this Agreement. CONTRACTOR shall promptly refund any such funds upon demand.

In addition to immediate suspension or termination, STUDY AGENCY may impose any other remedies available at law, in equity, or otherwise specified in this Agreement.

In the event of any breach of this Agreement, STUDY AGENCY, upon the recommendation of the Policy Committee, may, without prejudice to any of its other legal remedies, terminate this Agreement upon five (5) days' written notice to CONTRACTOR. In such event, STUDY AGENCY shall pay CONTRACTOR only the reasonable value of the services theretofore rendered by CONTRACTOR as may be agreed upon by the parties or determined by a court of law, but not in excess of the total Agreement price.

5. DATA

5.1 No reports, professional papers, information, inventions, improvements, discoveries or data obtained, prepared, assembled, or developed by CONTRACTOR pursuant to this Agreement shall be released or made available (except as otherwise provided herein) without prior written approval of the Chief of the Modeling and Meteorology Branch, Planning & Technical Support Division, Air Resources Board. The consent of the Chief of the Modeling and Meteorology Branch, Planning & Technical Support Division, Air Resources Board, shall not be unreasonably withheld.

5.2 All models used must be in the public domain. All model codes, inputs, and outputs, and data obtained, prepared, assembled or developed shall be provided to the Program Manager in a magnetic media acceptable to the Program Manager

6. REPORTS

6.1 CONTRACTOR shall place the following language in a conspicuous place on all monthly progress reports and on the final report:

"The statements and conclusions in this report are those of the Contractor and not necessarily those of the California Air Resources Board, the San Joaquin Valleywide Air Pollution Study Agency, or its Policy Committee, their employees or their members. The mention of commercial products, their source, or their use in connection with material reported herein is not to be construed as actual or implied endorsement of such products."

7. COMPENSATION/INVOICING

7.1 STUDY AGENCY agrees to pay CONTRACTOR and CONTRACTOR agrees to receive compensation at the rate specified in paragraph 7.6 of this Agreement.

7.2 The amount to be paid to CONTRACTOR under this Agreement includes all sales and use taxes incurred pursuant to this Agreement, if any, including any such taxes due on equipment purchased by CONTRACTOR. CONTRACTOR shall not receive additional compensation for reimbursement of such taxes and shall not decrease work to compensate therefor.

7.3 Advance payments shall not be permitted. Payments will be permitted only at which time-equivalent services have been satisfactorily rendered. Progress payments shall be subject to review by the ARB Program Manager and the STUDY AGENCY Technical Committee. Progress payments shall be made monthly upon receipt of an invoice, a monthly progress report, and a claim for payment form, which is attached as Exhibit C and incorporated herein by reference. Invoices will be sent to Chief, Modeling and Meteorology Branch, Planning & Technical Support Division, Air Resources Board, P.O. Box 2815, Sacramento, CA 95812. With respect to the payment period completed, the invoice shall set forth in detail, in accordance with the Agreement budget, charges for time expended on the project,

including the classification of personnel involved in such time expenditure, and the monthly, weekly, or hourly rates for such personnel, as appropriate. The invoice shall also contain an itemization of all materials used for the project, including the purpose of their use and their cost. Payment shall be made within thirty (30) days of receipt of the invoice.

7.4 Concurrently with the invoice, CONTRACTOR shall certify (i.e., through copies of issued invoices, checks, or receipts) that complete payment has been made to any and all subContractors and subconsultants as provided.

7.5 It is understood that all expenses incidental to CONTRACTOR's performance of services under this Agreement shall be borne exclusively by CONTRACTOR.

7.6 In no event shall compensation paid by STUDY AGENCY to CONTRACTOR for the performance of all services under this Agreement exceed COST.

7.7 STUDY AGENCY shall be solely responsible for payment and not any of the parties to the Joint Powers Agreement forming the STUDY AGENCY.

7.8 STUDY AGENCY shall withhold payment equal to ten percent (10%) of each monthly invoice until completion of work requested by the STUDY AGENCY Technical Committee on the tasks specified in Exhibit A and approval by the ARB Program Manager and the STUDY AGENCY Technical Committee. It is CONTRACTOR's responsibility to submit an invoice in triplicate for the ten percent (10%) withheld.

7.9 The terms of this Agreement and the services to be provided thereunder are contingent on the approval of funds by the appropriating government agency. Should sufficient funds not be allocated, the services provided may be modified or this Agreement terminated at any time by giving CONTRACTOR thirty (30) days' prior written notice.

8. EXTRA SERVICES

8.1 CONTRACTOR shall not undertake any extra services not enumerated herein unless expressly authorized by STUDY AGENCY through an amendment to this Agreement, which shall be executed in the same manner as this Agreement, or by express,

written authorization if such extra services are being performed by CONTRACTOR to wind up its services under this Agreement pursuant to subparagraph 4.1 of this Agreement.

8.2 When such extra services are being performed, CONTRACTOR shall keep complete records showing that STUDY AGENCY requested such extra services, the hours and description of activities worked by each person who worked on the project, the reason for such extra services, and all the costs and charges applicable to the extra services authorized.

9. INDEPENDENT CONTRACTOR

9.1 In performance of the work, duties, and obligations assumed by CONTRACTOR under this Agreement, it is mutually understood and agreed that CONTRACTOR, including any and all of CONTRACTOR's officers, agents, and employees, will at all times be acting and performing as an independent Contractor, and shall act in an independent capacity and not as an officer, agent, servant, employee, joint venturer, partner, or associate of the STUDY AGENCY or the Policy Committee.

9.2 Furthermore, STUDY AGENCY shall have no right to control, supervise, or direct the manner or method by which CONTRACTOR shall perform its work and function. However, STUDY AGENCY shall retain the right to administer this Agreement so as to verify that CONTRACTOR is performing its obligations in accordance with the terms and conditions thereof. CONTRACTOR and STUDY AGENCY shall comply with all applicable provisions of law and the rules and regulations, if any, of governmental authorities having jurisdiction over matters the subject thereof.

9.3 Because of its status as an independent Contractor, CONTRACTOR shall have absolutely no right to employment rights and benefits available to STUDY AGENCY employees. CONTRACTOR shall be solely liable and responsible for providing all legally required employee benefits. In addition, CONTRACTOR shall be solely responsible and save STUDY AGENCY harmless from all matters relating to payment of CONTRACTOR's employees, including compliance with Social Security, withholding, and all other regulations governing such matters. It is acknowledged that during the term of this Agreement,

CONTRACTOR may be providing services to others unrelated to STUDY AGENCY or to this Agreement.

10. MODIFICATION

10.1 Any matters of this Agreement may be modified from time to time by the written consent of all the parties without, in any way, affecting the remainder.

11. NON-ASSIGNMENT

11.1 Neither party shall assign, transfer, or subcontract this Agreement nor their rights or duties under this Agreement without the prior, express written consent of the other party.

12. INDEMNIFICATION

12.1 CONTRACTOR agrees to indemnify, save, hold harmless, and at STUDY AGENCY's request, defend STUDY AGENCY, its boards, committees, representatives, officers, agents, and employees from and against any and all costs and expenses (including reasonable attorneys fees and litigation costs), damages, liabilities, claims, and losses (whether in contract, tort, or strict liability, including, but not limited to, personal injury, death, and property damage) occurring or resulting to STUDY AGENCY which arises from any negligent or wrongful acts or omissions of CONTRACTOR, its officers, agents, subContractors, subconsultants, or employees in their performance of this Agreement, and from any and all costs and expenses (including reasonable attorneys fees and litigation costs), damages, liabilities, claims, and losses (whether in contract, tort, or strict liability, including, but not limited to, personal injury, death, and property damage) occurring or resulting to any person, firm, corporation, or entity who may be injured or damaged when such injury or damage arises from any negligent or wrongful acts, or omissions of CONTRACTOR, its officers, agents, subContractors, subconsultants, or employees in their performance of this Agreement.

13. INSURANCE

13.1 Without limiting STUDY AGENCY's right to obtain indemnification from CONTRACTOR or any third parties, CONTRACTOR, at its sole expense, shall maintain in full force and effect the following insurance policies throughout the term of this Agreement:

13.1.1 Comprehensive general liability insurance with minimum limits of coverage in the amount of _____ Million Dollars (\$) per occurrence;

13.1.2 Commercial automobile liability insurance for owned and non-owned vehicles which covers bodily injury and property damage with a combined single limit with minimum limits of coverage in the amount of _____ Million Dollars (\$) per occurrence;

13.1.3 Workers Compensation Insurance, in accordance with California law.

13.2 Such insurance policies shall name STUDY AGENCY, its officers, agents, and employees, individually and collectively, as additional insured but only insofar as the operations under this Agreement are concerned. Such coverage for additional insured shall apply as primary insurance, and any other insurance, or self-insurance, maintained by STUDY AGENCY, its officers, agents, and employees shall be excess only and not contributing with insurance provided under CONTRACTOR's policies herein. This insurance shall not be cancelled or changed without a minimum of thirty (30) days' advance, written notice given to STUDY AGENCY.

13.3 Prior to the commencement of performing its obligations under this Agreement, CONTRACTOR shall provide certificates of insurance on the foregoing policies, as required herein, to STUDY AGENCY stating that such insurance coverages have been obtained and are in full force; that STUDY AGENCY, its officers, agents, and employees will not be responsible for any premiums on the policies; that such insurance names STUDY AGENCY, its officers, agents, and employees, individually and collectively, as additional insured, but only insofar as the operations under this Agreement are concerned; that such coverage for additional insured shall apply as primary insurance, and any other insurance or self-insurance maintained by STUDY AGENCY, its officers, agents, and employees, shall be excess only and not contributing

with insurance provided under CONTRACTOR's policies herein. This insurance shall not be cancelled or changed without a minimum of thirty (30) days' advance, written notice given to the STUDY AGENCY.

13.4 In the event CONTRACTOR fails to keep in effect at all times insurance coverage as herein provided, STUDY AGENCY may, in addition to other remedies it may have, suspend or terminate this Agreement upon the occurrence of such event.

13.5 If the CONTRACTOR is a government entity, then it may self-insure such of those risks identified in paragraphs 13.1.1 through 13.1.3 of this Agreement, provided, however, that:

13.5.1 STUDY AGENCY, its officers, agents, and employees, individually and collectively, shall be named as additional insured (except for Workers Compensation Insurance) on CONTRACTOR's self-insurance plan, but only insofar as the operations under this Agreement are concerned;

13.5.2 Such self-insurance plan shall be reasonably satisfactory to STUDY AGENCY; and

13.5.3 All those provisions identified in subparagraph 13.2 of this Agreement concerning the relationship of CONTRACTOR's primary and STUDY AGENCY's excess insurance to each other, the requirement of CONTRACTOR delivering a certificate of insurance or other suitable evidence to STUDY AGENCY, and the cancellation/change of insurance requirements shall apply to such self-insurance plan.

14. AUDITS AND INSPECTIONS

14.1 CONTRACTOR shall at any time during business hours, and as often as STUDY AGENCY may deem necessary, make available to STUDY AGENCY for examination all of its records and data with respect to the matters covered by this Agreement. CONTRACTOR shall, upon request by STUDY AGENCY, permit STUDY AGENCY to audit and inspect all of such records and data necessary to ensure CONTRACTOR's compliance with the terms of this Agreement.

14.2 CONTRACTOR shall maintain books, records, documents, and other evidence pertaining to the reimbursable time and materials and hold them available for audit and inspection by STUDY AGENCY for a minimum of three (3) years from the date this Agreement is completed or otherwise terminated.

15. BUDGET

15.1 CONTRACTOR shall be authorized to rebudget funds up to a maximum of twenty percent (20%) between major categories in the contract budget as contained in Exhibit A. All rebudgeting in excess of twenty percent (20%) requires the prior written approval of the Chief of the Modeling and Meteorology Branch, Planning and Technical Support Division, Air Resources Board, or his representative. Under no circumstances shall the total contract amount exceed *COST*.

16. NOTICES

16.1 The persons and their addresses having authority to give and receive notices under this Agreement include the following:

STUDY AGENCY:	John DaMassa, Chief
	Modeling and Meteorology Branch
	Planning & Technical Support Division
	Air Resources Board
	P.O. Box 2815
	Sacramento, CA 95812
CONTRACTOR:	<i>CONTACT PERSON</i>
	<i>ADDRESS</i>

16.2 Any and all notices between STUDY AGENCY and CONTRACTOR provided for or permitted under this Agreement or by law shall be in writing and shall be deemed duly served when personally delivered to one of the parties, or in lieu of such personal services, when deposited in the United States mail, postage prepaid, addressed to such party.

17. DISPUTES

17.1 In the event a dispute between CONTRACTOR and the ARB Program Manager, CONTRACTOR should first discuss the problem informally with the ARB Program Manager. If the dispute is not resolved, the following two-step procedure shall be followed by both parties:

17.1.1 CONTRACTOR and the ARB Program Manager shall each write to the STUDY AGENCY Technical Committee stating the issues in the dispute and the basis for their positions. The STUDY AGENCY Technical Committee shall make a determination within fourteen (14) working days after receipt of the written communications from CONTRACTOR and ARB Program Manager. The STUDY AGENCY Technical Committee shall notify CONTRACTOR and the ARB Program Manager in writing of the decision and the reasons therefor.

17.1.2 If CONTRACTOR or the ARB Program Manager disagrees with the STUDY AGENCY Technical Committee's decision, written notice shall be provided to the other party of an intention to seek non-binding third-party mediation of the dispute. Both parties must agree to submit to mediation. The dispute shall be considered by a panel of three (3) experts in the field of dispute. Each party shall have the right to select one panelist. The selected panel will then select a third member. The panel shall set a hearing date, time, and place convenient to the parties within thirty (30) days of panel selection. Within five (5) working days of the hearing date, each party shall submit a written statement to the panel and the other party setting forth the issues and arguments to be presented. The hearing shall be informal with an opportunity for both parties to present their arguments. The panel shall provide the parties with a written decision within thirty (30) days of the hearing. The decision shall be binding on the parties, unless referred to the Governing Board within thirty (30) days. The costs of the panel shall be borne equally by the parties.

17.1.3 If either party has so requested, the matter shall be heard by the STUDY AGENCY Board, and the Board's determination shall be final.

18. POLITICAL ACTIVITY PROHIBITED

18.1 None of the funds, materials, property, or services provided under this Agreement shall be used for any political activity, or to further the election or defeat of any candidate for public office contrary to federal or state laws, statutes, regulations, rules or guidelines.

19. LOBBYING PROHIBITED

19.1 None of the funds provided under this Agreement shall be used for publicity, lobbying, or propaganda purposes designed to support or defeat legislation before the Congress of the United States of America or the Legislature of the State of California.

20. CONFLICT OF INTEREST

20.1 No officer, employee, or agent of STUDY AGENCY who exercises any function or responsibility for planning and carrying out the services provided under this Agreement shall have any direct or indirect personal financial interest in this Agreement. CONTRACTOR shall comply with all federal and state conflict of interest laws, statutes, and regulations which shall be applicable to all parties and beneficiaries under this Agreement and any officer, agent, or employee of STUDY AGENCY.

21. COMPLIANCE WITH LAWS

21.1 CONTRACTOR shall comply with all federal and state laws, statutes, regulations, rules, and guidelines which apply to its performance under this Agreement.

22. SEVERABILITY

22.1 In the event that any one or more provisions contained in this Agreement shall for any reason be held to be unenforceable in any respect by a court of competent jurisdiction, such holding shall not affect any other provisions of this Agreement, and the Agreement shall then be construed as if such unenforceable provisions are not a part hereof.

23. TIME IS OF THE ESSENCE

23.1 It is understood that for CONTRACTOR's performance under this Agreement, time is of the essence. The parties reasonably anticipate that CONTRACTOR will, to

the reasonable satisfaction of STUDY AGENCY, complete all services to be provided hereunder by *DATE*, provided that CONTRACTOR neither causes nor is caused unreasonable delay in such performance.

24. GOVERNING LAW

24.1 Venue for any action arising out of or relating to this Agreement shall only be in Fresno County, California.

24.2 The rights and obligations of the parties and all interpretation and performance of this Agreement shall be governed in all respects by the laws of the State of California.

25. BINDING UPON SUCCESSORS

25.1 This Agreement, including all covenants and conditions maintained herein, shall be binding upon and inure to the benefit of the parties, including their respective successors-in-interest, assigns, and legal representatives.

26. INSPECTION AND RELEASE OF DATA

26.1 Upon termination or expiration of this Agreement, all data which is received, collected, produced, or developed by CONTRACTOR under this Agreement shall become the exclusive property of STUDY AGENCY, provided, however, CONTRACTOR shall be allowed to retain a copy of any non-confidential data received, collected, produced, or developed by CONTRACTOR under this Agreement, subject to STUDY AGENCY's exclusive ownership rights stated herein. Accordingly, CONTRACTOR shall surrender to STUDY AGENCY all such data which is in its (including its subContractors, subconsultants, or agents) possession, without any reservation of right or title not otherwise enumerated herein.

26.2 STUDY AGENCY shall have the right, at reasonable times during the term of this Agreement, to inspect and reproduce any data received, collected, produced, or developed by CONTRACTOR under this Agreement. No reports, professional papers, information, inventions, improvements, discoveries, or data obtained, prepared, assembled, or developed by CONTRACTOR, pursuant to this Agreement, shall be released or made available

(except to STUDY AGENCY) without prior, express written approval of STUDY AGENCY while this Agreement is in force.

27. NONDISCRIMINATION

27.1 The provisions of Exhibit D, the "Nondiscrimination Clause," is attached hereto and incorporated herein.

28. ENTIRE AGREEMENT

28.1 This Agreement, including all attached exhibits and documents which are referred to and incorporated herein, constitutes the entire agreement between CONTRACTOR and STUDY AGENCY with respect to the subject matter hereof and supersedes all previous negotiations, proposals, commitments, writings, advertisements, publications, and understandings of any nature whatsoever unless expressly included in this Agreement.

29. WAIVER

29.1 No waiver of any breach of this Agreement shall be held to be a waiver of any other or subsequent breach. All remedies afforded in this Agreement shall be taken and construed as cumulative, that is, in addition to every other remedy provided therein or by law. The failure of STUDY AGENCY to enforce at any time any of the provisions of this Agreement or to require at any time performance by CONTRACTOR of any of the provisions therefor, shall in no way be construed to be a waiver of such provisions nor in any way affect the validity of this Agreement or any part thereof or the right of STUDY AGENCY to thereafter enforce each and every such provision.

IN WITNESS WHEREOF, the parties hereto have executed this Agreement as of the day and year first hereinabove written through their respective duly appointed and authorized representatives.

STUDY AGENCY

SAN JOAQUIN VALLEYWIDE AIR
POLLUTION STUDY AGENCY

CONTRACTOR

By _____

Chair

By _____

Print Name and Title

Tax I.D. No.

Recommended for approval:

SAN JOAQUIN VALLEYWIDE AIR
POLLUTION STUDY AGENCY
POLICY COMMITTEE

Approved as to legal form:

SAN JOAQUIN VALLEY UNIFIED AIR
POLLUTION CONTROL STUDY
AGENCY

By _____

Title _____

By _____

Philip M. Jay

Study Agency Counsel

Recommended for approval:

SAN JOAQUIN VALLEYWIDE AIR
POLLUTION STUDY AGENCY
TECHNICAL COMMITTEE

Approved as to accounting form:

SAN JOAQUIN VALLEY UNIFIED AIR
POLLUTION CONTROL STUDY
AGENCY

By _____

Title _____

By _____

Roger W. McCoy

Finance Officer